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Chapter 1

HORIZONTAL CONTROL (HZTL) DATA

INTRODUCTION

For coding and processing purposes, data associated with geodetic horizontal control (HZTL data) have been divided into two groups. These two groups are (1) field observations (OBS data) and (2) descriptions and recovery notes (DESC data). Detailed instructions and formats for coding and keying horizontal control OBS and DESC data sets are contained in Chapters 2 and 3. The treatment of all data normally generated in the conduct of a classical horizontal control survey (triangulation, trilateration, and/or traverse) is described.

Although both types of data are normally generated in a horizontal control survey, OBS and DESC data must be submitted to NGS in separate data sets. These will be inserted in the National Geodetic Survey Data Base.

The foregoing implies that every horizontal control survey project (or several small projects submitted as one "job" - see below) will be received at NGS as two distinct data sets HZTL OBS and GEOD DESC data sets. The two data sets created for each horizontal control job must be submitted at the same time.

JOB CODE AND SURVEY POINT NUMBERING

The basic unit or group of data is given the name "job." A horizontal control job can contain the data for a maximum of 9999 survey points - see the definition of "survey point" below. If the number of survey points in a horizontal control survey project exceeds this limit, the data must be divided and submitted in multiple jobs. A job will normally contain the data collected for one project (i.e., one unit of field work); however, several small projects can be included in one job, even though they may have no points in common. The preferred determining factor in selecting several small horizontal control survey projects for inclusion in any one job is geographic proximity.

A two-character alphanumeric job code must be assigned to each horizontal control job submitted by an organization. The job code, along with the data set type, the name of the submitting agency, and the data set creation date will serve to uniquely identify each data set received by NGS. The first character of the two-character job code must always be a letter; the second character may be either a letter or a number (1 through 9). The preferred method of assigning job codes is to begin with A1 and end with ZZ, i.e., A1, A2, ..., A9, B1, ..., Z1, ..., Z9, AA, AB, ..., ZZ. This allows for a total of 910 uniquely-identified horizontal control jobs to be submitted by any one organization. Should this sequence be exhausted, the job codes may then be assigned again from the beginning - A1, A2, etc.

A horizontal control point is defined as any survey point whose position has been previously determined and is in the NGS Data Base, whose position is to be determined in an adjustment of the submitted HZTL OBS data, or whose (adjusted) position is available from another source. A survey point is defined as any point which has one or more directions, angles (horizontal or vertical), distances or vectors measured to it or from it. A survey point may be a monumented (or otherwise permanently marked) control point, a reference mark or azimuth mark, a temporary point (not permanently marked and therefore non-recoverable) such as an auxiliary point, or an unmonumented recoverable landmark (usually an intersection station) such as a flagpole or church spire. An eccentric instrument setup and eccentric target (or reflector) also qualify as survey points under this definition.

Each survey point in a horizontal control job must be assigned a unique four-digit station serial number within the range 0001 through 9999. A unique station serial number not only identifies the various observations within the HZTL OBS data set but is the project specific link between data in the HZTL OBS data set and data in the GEOD DESC data set.

Normally there are many survey points in a horizontal control job which are not intended as control points. These points are, by their nature, peripheral to a control point. Examples of peripheral points are unoccupied reference and azimuth marks. Eccentric instrument setups and eccentric targets (or reflectors) are treated as peripheral points if the respective eccentric observations are to be reduced to center. This is usually the case when the eccentric point is not permanently marked. But, if an eccentric point is offset more than 10 meters from the control point to which it belongs (even though it may be unmarked), or if the eccentric point is permanently marked (e.g., a reference mark is occupied), then the respective eccentric observations should not be reduced to center, and the eccentric point should be treated as another control point.

When an eccentric instrument setup is utilized in a field project, whose offset distance from the respective control point does not exceed 10 meters, the respective eccentric observations should be reduced to center by the submitting organization and coded in the HZTL OBS deck as if the control station had been occupied. If, for any reason, this is not desired, the eccentric point in question must be carried as a control point and must be assigned a four-digit station serial number of its own.

An unoccupied reference or azimuth mark has one or more directions, angles, and/or distances measured to it but not from it. A reference mark or azimuth mark which is occupied as a part of the survey scheme (e.g., as an eccentric occupation of the respective control point) should always be treated as a distinct control point. However, a reference or azimuth mark with directions, angles, and/or distances measured from it (as well as to it) for the purpose of verifying and/or supplementing the observations which tie together the control point and its peripheral points may remain a peripheral point.

The observations (directions, angles, and/or distances) which link the peripheral points with the respective control points must appear in the appropriate subset of the HZTL OBS data set (see Chapter 2).

Figures 1-1 and 1-2 illustrate an assignment of station serial numbers to control points and to their peripheral points (reference marks, azimuth marks, and/or eccentric points). The numbering system provides unique identifiers for all the survey points. An AZ MK or RM which is being treated as a control point must not also be identified as a peripheral point in the OBS data set. The same station serial number must be consistently used throughout the OBS or DESC data set of a horizontal control job.

As stated in the INTRODUCTION, a horizontal control job consists of two separate data sets - the HZTL OBS data set and the GEOD DESC data set. The HZTL OBS data set may contain a greater number of points than the corresponding GEOD DESC data set. This might occur when there is no descriptive data for the peripheral points and for unmarked (auxiliary) points. Station descriptions or recovery notes are required only for recoverable survey points. Apart from the peripheral points, there may be a number of nonrecoverable control points (either originally unmarked or confirmed lost) which must be carried along in the OBS data set for network integrity purposes. There may also be recovery notes for stations not used or found destroyed in a survey. Observations for such stations would not be in the OBS data set. In isolated instances, there may be recoverable control points for which no descriptive data are available. In these instances the submitting organization should write a description for each recoverable control point and include it in the GEOD DESC data set.

When recording data on magnetic tape or floppy disks (see MEDIA FOR SUBMITTING DATA), the two data sets of a horizontal control job must be submitted in separate files. These files may be on the same disk/reel of tape or on different disks/reels. In any case, the first record of every data set (see Chapters 2 and 3) must contain information positively identifying the data and project: the job code, the data set type, the name of the submitting agency, and the data set creation date.

MEDIA FOR SUBMITTING DATA

Although, in principle, any computer-readable, general-purpose data-recording medium can be handled, the two media currently acceptable to NGS are the 5 1/4 inch and 3 1/2 inch floppy disk and the standard 1/2 inch magnetic tape. Magnetic tape should be used only as the medium for submitting large volumes of data. **Floppy disks are preferred** when submitting a single job or jobs which contain small to medium amounts of data.

When data are submitted on floppy disks, the files must be created using an MS DOS operating system and be in ASCII character format.

The following information must be provided for each floppy disk submitted:

1. Complete name and address of the submitting agency.
2. Number of files and the name of each file on the disk.
3. Method of keying data and machine used (e.g., MTEN on the IBM PC).
4. Disk format (360 k, 750 k, 1.2 m, or 1.4 m are acceptable).
5. Name and telephone number of the person to be contacted in case of difficulty with the data.

This information should be furnished in a letter of transmittal. A copy should be packed with the data set.

When the data are submitted as files of formatted records on magnetic tape, the following information is expected to be given for each reel of tape:

1. Name and address of the submitting agency.
2. Reel number or identification symbol assigned by the submitting agency.
3. Number of files and contents of each file by job code and data type (e.g. A1 HZTL OBS, XX GEOD DESC, etc.).
4. Computer system on which the tape was created (e.g., IBM 360/XXX, CDC 6600, etc.).
5. Internal label information (e.g. non-labeled, standard IBM label, etc.).
6. Number of tracks (7 or 9) and parity (even or odd).
7. Recording density (556, 800 or 1600 BPI).
8. Record length (LRECL) and block size (BLKSIZE).
9. Character representation code (BCD, EBCDIC, etc.) and keytape equipment designation, if applicable.
10. Name and phone number of person to be contacted in case of difficulty with the data.

This information should be furnished in a letter of transmittal. A copy should be packed with the data set.

A letter describing and itemizing the data transmitted should always be prepared for each data shipment. One copy should be enclosed with the data shipment, one sent by separate mail to NGS, and another copy retained by the sender. See ANNEX K for current mailing instructions. In every case, the submitting organization should retain a backup copy of all the data shipped until NGS acknowledges receipt of the data.

CODING, KEYING, AND DATA VERIFICATION

All data submitted to NGS for insertion into the National Geodetic Survey Data Base must be coded and keyed in strict conformity with the formats and specifications contained in this publication. In addition, the keying of all data must be verified.

Detailed formats and specifications for the coding and keying of horizontal control jobs are contained in Chapter 2 (HZTL OBS data) and in Chapter 3 (GEOD DESC data). The formats were designed to allow the keying and verification of the data to be accomplished on standard computer equipment, hence the 80-character record was adopted as the standard for all applications.

When coding and keying the data entries, carefully insure that alphabetic characters (letters) will be keyed using the alphabetic keys, and that numeric characters (numbers) will be keyed using the numeric keys. In particular, miscoding and miskeying the following characters must be avoided:

0 - number "zero"	1 - number "one"	2 - number "two"
0 - letter "O"	L - letter "L"	Z - letter "Z"

SPECIAL CHARACTERS

In addition to the alphabetic characters (letters A through Z) and the numeric characters (numbers 0 through 9), only the following special characters are allowed:

(*) asterisk	(+) plus sign
() blank or space	(-) minus sign or hyphen
(,) comma	(=) equal sign
(.) period or decimal point	(/) slash or solidus
(\$) dollar sign	(() left parenthesis
	()) right parenthesis

SEQUENTIAL RECORD NUMBERING

The first six characters of every record are reserved for a record sequence number. The purpose of numbering records sequentially is to insure that the proper sequence of individual records in a data set can be verified and, if necessary, restored. The sequencing numbers must be assigned in ascending order, starting with the first record (the Data Set Identification Record) and ending with the last record (the Data Set Termination Record).

The preferred assignment of sequence numbers starts with 000010 on the first record in the data set (the Data Set Identification Record) and increments by 10 on each successive record. This numbering system allows up to nine records to be inserted between any two originally numbered records without the necessity of renumbering any records in the data set. Even when a large block of omitted records must be inserted, only a few of the existing records will have to be renumbered. To allow for the detection of missing records, all insertions and/or deletions which deviate from the basic 000010, 000020, 000030, etc. "increment-by-ten" record sequence must be accounted for in the letter of transmittal.

Discounting any after-the-fact insertions, the above-described sequential numbering system will permit a maximum of 99,999 uniquely-numbered records in any one data set. Should there ever be a need for a greater number of records in a data set, retain only the last six digits of the higher sequence numbers, i.e., ... 999980, 999990, 000000, 000010, etc.

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